

**CLAIMS****What is claimed is:**

- 5 1. A copper- nickel-silicon quench substrate for rapid solidification of molten alloy into strip, having a two-phase microstructure with cells of copper rich regions surrounded intimately by a discontinuous network of nickel silicide and chromium silicide phases.
2. A quench substrate as recited in claim 1, wherein said thermally conducting alloy is a copper- nickel silicon alloy consisting essentially of about 6- 8 wt% nickel, about 1 – 2  
10 wt% silicon, about 0.3-0.8 wt% chromium, the balance being copper and incidental impurities.
3. A quench substrate as recited in claim 2, wherein said thermally conducting alloy is a copper- nickel silicon alloy consisting essentially of about 7 wt% nickel, about 1.6 wt.% silicon, about 0.4wt% chromium, the balance being copper and incidental impurities.
- 15 4. A quench substrate as recited in claim 1, wherein said cell of the two-phase structure has size ranging from 1 to 1000  $\mu\text{m}$ .
5. A quench substrate as recited in claim 4, wherein said cell structure of the two-phase structure has size ranging from 1 to 250  $\mu\text{m}$ .
6. A process for forming a quench casting wheel substrate comprising the steps of:  
20 a. casting a copper-nickel-silicon two phase alloy billet having a composition consisting essentially of about 6- 8 wt% nickel, about 1 – 2 wt% silicon, about 0.3-0.8 wt% chromium, the balance being copper and incidental impurities;

- b. mechanically working said billet to form a quench casting wheel substrate said mechanical working being carried out at a temperature ranging from about 760 to 955 °C; and
  - c. heat treating said substrate to obtain a two-phase microstructure having a cell size ranging from about 1-1000  $\mu\text{m}$ , said heat treating being carried out at a temperature ranging from about 440 to 955 °C;.
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- 7. A process as recited by claim 6, wherein said mechanical working step includes the step of extruding said billet to break down the residual silicide structure that forms during solidification of the cast ingot and to create sufficient strain to induce nucleation and grain growth uniformly through the entire part.
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- 8. A process as recited by claim 6, wherein said mechanical working step includes the step of ring rolling said billet to break down the residual silicide structure that forms during solidification of the cast ingot and to create sufficient strain to induce nucleation and grain growth uniformly through the entire part.
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- 9. A process as recited by claim 6, wherein said mechanical working step includes the step of saddle forging said billet to break down the residual silicide structure that forms during solidification of the cast ingot and to create sufficient strain to induce nucleation and grain growth uniformly through the entire part..
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- 10. A process as recited in claim 6, wherein the mechanical working steps produce mechanical strain equivalent to a reduction in area ranging from at least about 7:1 to 30:1.
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- 11. A process as recited in claim 6, wherein said heat treating is a two-stage process wherein the first stage is a heat treatment for a time from about 1 to 8 hours at a temperature from

about 955 to 995 °C, and the second stage is a heat treatment to nucleate and grow the silicide phases for a time of about 1 to 5 hours at a temperature of about 440 to 495 °C.